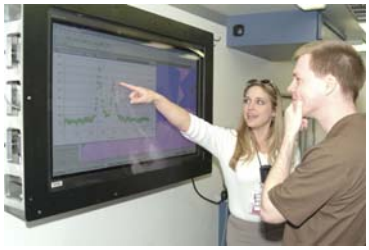
SRNL

Savannah River National Laboratory News

We Put Science To Work ™ Volume 1, No. 2, Second Quarter, 2005

News from the Savannah River National Laboratory



The Plasma Screen Floating Mount has been installed in SRNL's mobile monitoring van, where it allows the use of a large plasma screen display.

SRNL Design Named One of World's Best Technologies

For the second year in a row, an invention from the Savannah River National Laboratory (SRNL) has been named one of the World's Best Technologies. The Plasma Screen Floating Mount, invented by Don Pak and Bob Eakle of SRNL, was one of the featured inventions at the World's Best Technologies for 2005 (WBT05) Showcase in Arlington, Texas in March. The mount allows large flat-panel display screens to be used in moving vehicles.

The WBT05 is an international showcase for new technologies developed at the nation's top universities, federal labs, federally supported research and development institutions, and private companies. Each year, a seasoned screening panel of investors and commercialization experts selects up to 75 exhibitors that have the greatest potential for high growth commercial enterprises. From that group, the top 25 exhibitors are chosen for special attention. The Plasma Screen Floating Mount was chosen as one of that top 25. World's Best Technologies, produced in cooperation with the Federal

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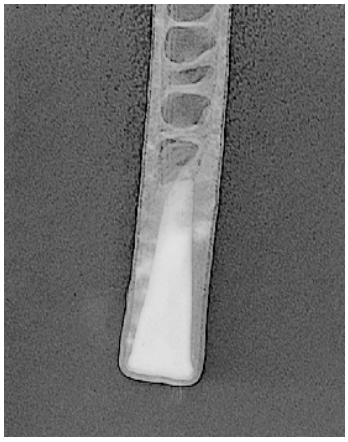

Carbon nanotubes — tiny structures 1/10,000 the width of a human hair — show promise as a means of storing hydrogen in a solid state.

DOE Selects SRNL Hydrogen Research Project

A Savannah River National Laboratory research project on novel materials for hydrogen storage has been selected by the U.S. Department of Energy as part of their effort to make hydrogen fuel cell vehicles and refueling stations available, practical and affordable for American consumers by 2020. Secretary of Energy Samuel W. Bodman announced May 25 that SRNL's project was among 70 research projects nationwide that were selected - using a merit-reviewed, competitive solicitation process - to focus on fundamental science and enable revolutionary breakthroughs in hydrogen production, hydrogen storage and new fuel cell technologies.

"DOE's initiative will advance the scientific knowledge necessary to make hydrogen a part of our everyday energy supply," said Dr. G. Todd Wright, Laboratory Director of SRNL. "Being a part of this initiative is a real testament to the importance of the leading-edge hydrogen research that SRNL is conducting."

The SRNL-led basic science research project, which is estimated at approximately one-half million dollars a year for the next three years, explores the role of nanotechnology in hydrogen storage.

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Bagless Transfer System and 3013 Containers

Pictured underneath the glove box is the Bagless Transfer System during development testing.

The announcement earlier this year that the Savannah River Site's (SRS) FB-Line had produced their last bagless transfer can of plutonium and welded the last outer 3013 container was news well beyond the Site's F Area.

The SRNL-developed Bagless Transfer System (BTS) not only made it possible for FB-Line to reach this milestone, it has enabled customers throughout the Department of Energy complex to achieve success in safely packaging nuclear materials. SRNL's reputation for developing and deploying practical, cost-effective solutions has been enhanced by the success that the customers have achieved using BTS.

SRNL's Engineered Equipment and Systems (EES) and Materials Technology Section (MTS) designed, built, and installed the first BTS unit in FB-Line in 1997 as a prototype to test in a run of 100 cans. Because FB-line is very cramped, EES was faced with designing an economical solution that fit under a glovebox.

SRNL's success in meeting this challenge resulted in interest from Hanford, and SRNL then built two similar Bagless Transfer Systems for them. Between the systems at SRS and at Hanford, laboratory personnel estimate that the SRNL-designed equipment has packaged approximately two-thirds of the nation's inventory of excess plutonium.

The patented system transfers nuclear material (plutonium) from a glovebox directly into a stainless steel container without the use of plastic bags (hence the name "bagless"). Decomposition of plastic material traditionally used to "bag out" nuclear material from gloveboxes can result in pressurization and increase the potential for failure of some storage containers. Stainless steel was used for the cans so they wouldn't degrade over time and could ensure long-term safe storage. The system integrates commercially available welding/cutting equipment into a semi-automated machine and is adaptable to existing glovebox lines at many sites within the DOE complex.

This inner "bagless transfer" can is then placed into an outer stainless steel can. The entire nested "can in a can" package is called a 3013 storage package. EES, along with MTS, also developed the Outer Can Welder to weld the stainless steel double-canned system shut.

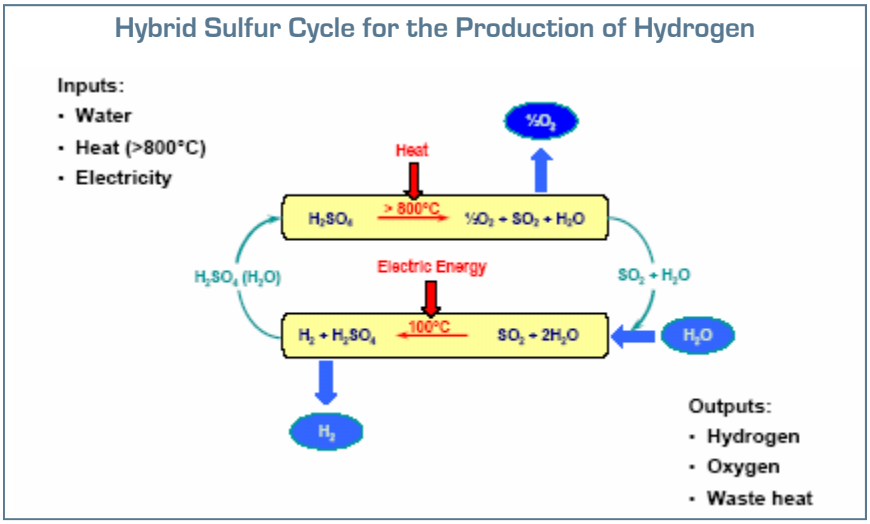
After welding, the 3013 package is sent to a Digital Radiography System that EES also developed. This system screens the weld to ensure quality. It also takes a baseline image of the package to be used as a comparison throughout the package's storage life to measure any internal pressure build up. SRNL also developed two Automatic Leak Detector systems that check the weld for leaks by "looking" for the helium that has been injected into both the inner and outer can before welding.

The success of this equipment has led to new work developing Surveillance and Maintenance Repackaging Equipment for SRS's K-Area Material Storage facility. With this new system, these cans could be pulled from storage, examined, and if necessary, repackaged to ensure safe storage. This system will probably soon be used throughout the complex for all 3013's.

ENERGY SECURITY

Hybrid Sulfur Flowsheet for the Nuclear Production of Hydrogen

One of the very promising approaches being studied for the production of the large quantities of hydrogen that will be needed in the future is the use of nuclear technology combined with a thermochemical cycle. Thermochemical cycles use heat — in this case, heat produced in a nuclear reactor — to drive chemical reactions that split water into hydrogen and oxygen.



SRNL researchers studying one of those cycles, called the Hybrid Sulfur Cycle, have developed an improved flowsheet that raises the process's thermal efficiency, the critical performance measure for a thermochemical cycle. The term "hybrid" means that the cycle uses electric energy — which can also be produced with a nuclear reactor — as well as heat to split the water.

Westinghouse Electric Corporation first developed the Hybrid Sulfur Cycle in the late 1970s. Work was suspended in the 1980s, but recent years' events have brought renewed interest in the hydrogen economy and nuclear power, and SRNL resumed development work, leading to these new improvements. Laboratory-scale development work is continuing, including development of a bench-scale electrolyzer. The electrolyzer distinguishes the Hybrid Sulfur from other sulfur-based cycles. It is the process unit that uses electric energy to drive one of the two key reaction steps in the cycle.

The thermal efficiency of the flowsheet relates to how much of the energy consumed to make the hydrogen is recovered as the fuel value of the product. Water splitting processes that use simple, low temperature electrolysis — the current technology — are limited to no better than 36 to 38% efficiency on higher heating value (HHV) basis. SRNL researchers have devised Hybrid Sulfur Cycle flowsheets that exceed 50% efficiency (HHV basis). This is a significant result because the most expensive component of a nuclear heat-driven hydrogen production process would be the nuclear plant energy source. A Hybrid Sulfur process operating at 50% net thermal efficiency could squeeze 35% more production capacity out of a given nuclear heat source than a simple electrolysis plant, affording the promise of cheaper hydrogen.

NATIONAL AND HOMELAND SECURITY

Innovative Fingerprint Detection Device Patented

SRNL's BritePrint™ device gives law enforcement personnel an inexpensive, practical method for on-the-scene fingerprint detection.

An innovative tool developed by a researcher at the Savannah River National Laboratory to give law enforcement personnel a method for on-the-scene fingerprint detection has been issued a patent by the U.S. Patent and Trademark Office.

The BritePrint™ device, invented by SRNL's Eliel Villa-Aleman is a small, lightweight, battery-powered, high intensity light source that saves investigators valuable time in the investigation process. When used in conjunction with traditional dust detection methods, BritePrint reveals otherwise invisible fingerprints, footprints and other latent markings at crime scenes.

The research and development of the device was funded by the Department of Energy's National Nuclear Security Administration's (NNSA) Office of Nonproliferation Research and Funding.

"That's what's really gratifying about being an applied research and development laboratory," said Dr. Todd Wright, SRNL Laboratory Director. "Being able to put science to work to deliver practical technologies that are truly beneficial to the people who will use them — especially when those users are the law enforcement personnel who do so much to help all of us."

The typical method for detecting prints is a slow, cumbersome operation, in which personnel hold a heavy light source – sometimes for hours at a time – while using tape to lift prints.

The lightweight BritePrint device would typically be worn on a headset for hands-free operation. It uses light emitting diodes (LEDs) to produce light at a specific wavelength that causes areas brushed with dye to be visibly fluorescent. Wearing light-filtering goggles makes markings in these areas easily detectible by the human eye, allowing an analyst to quickly proceed with on-site detection and subsequent analysis of prints. Its small design allows it to illuminate hard-to-reach places not readily reached by traditional light sources. Unlike traditional light sources, it has its own power source, so it does not need to be plugged into a wall outlet, allowing it to be used in remote or outdoor environments. It can also be used with a video camera for recording critical crime scene evidence.

It is designed to be low-cost, so that small law enforcement agencies can take advantage of the technology.

The BritePrint device has been beta tested or used by more than a half-dozen law enforcement offices in the Southeast.

Sequiam Corporation of Orlando, Fla., has licensed BritePrint to manufacture and commercialize the device for use by law enforcement agencies.

The development of the BritePrint device grew out of an agreement with the National Institute of Justice to apply existing SRNL capabilities to meeting law enforcement needs. When law enforcement personnel indicated the need for a lightweight, easily handled light source, SRNL applied its years of experience in the development of sensors for a wide variety of uses to come up with BritePrint.

ENVIRONMENTAL AND PROCESS TECHNOLOGY

Potentially Wider Use of the Alternate Species Toxicity Test

SRNL researchers found that the local species *Daphnia ambigua* is unaffected by the softness of South Carolina's water, making it a more accurate indicator of toxicity. (Photo from Rowe,C.L. and Hebert, P.D.N. 1999. Cladoceran Web Site. University of Guelph www.cladocera.uoguelph.ca)

Back in 2003, SRNL developed an alternate method of testing outfalls for toxicity, substituting a local species of water flea (cladoceran) for the species that had traditionally been used as an indicator of toxic chemicals. This new method has proved highly successful at detecting toxicity, while reducing the number of false positive readings. As a result, SRNL has now developed a list of screening criteria that can be used by the South Carolina Department of Health and Environmental Control in determining the appropriateness of the alternate species toxicity test for other (National Pollution Discharge Elimination System) NPDES dischargers in South Carolina.

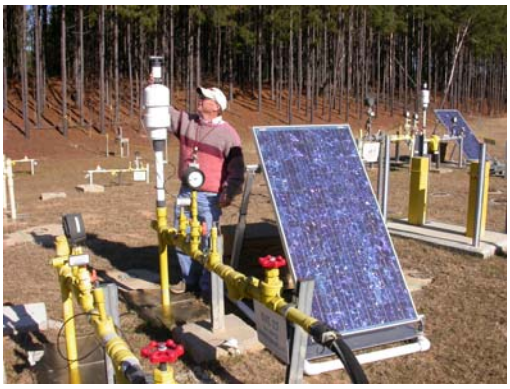
The traditional test for measuring toxicity in outfalls involved studying the reproduction of Ceriodaphnia dubia, a species of zooplankton (commonly called water fleas). Since this species is not indigenous to Savannah River Site waters, SRNL determined that the water fleas' failure to reproduce — which had been interpreted as an indication of water toxicity — was instead caused by their intolerance of the natural low hardness (low calcium and magnesium) of the local water.

SRNL research showed that the use of a local species that thrives in water with very low hardness, Daphnia ambigua, solved the problem, and developed a test using the alternate species that met the Environmental Protection Agency's requirements.

MicroBlower Deployment at C-Area Burning Rubble Pit

SRNL has assembled and deployed four 24V MicroBlower systems at an environmental remediation site at the Savannah River Site. The MicroBlower, invented by SRNL's Joseph Rossabi, W. Keith Hyde, Brian Riha, Dennis Jackson and Frank Sappington, was one of two SRNL technologies selected for the 2004 World's Best Technologies exhibit.

MicroBlowers are low powered DC systems to extract or inject gases into the subsurface for characterization or remediation. The MicroBlower makes possible the use of semi-passive soil vapor extraction (SVE) in shallower areas than were previously considered possible. Perhaps the greatest potential for the MicroBlower is in economically completing the final cleanup of a solvent contaminated area that had been previously been treated with a larger, more expensive blower system.



MicroBlower system at the C-Area Burning Rubble Pit.

The recently installed 24V MicroBlower systems are designed to operate 24 hours a day by utilizing a battery bank charged by solar panels. The microblowers are being used as a final remediation after traditional SVE has reached the point of diminishing returns.

The system was installed at the C-Area Burning Rubble Pit, one of the Savannah River Site's environmental remediation projects. The pit was used from the early 1960s until 1973 for the disposal and burning of organic liquids such as waste oils, rags, paper, plastics, and rubber materials. After 1973, the pit was filled with construction debris and backfilled with native soil. Characterization studies confirmed the presence of volatile organic compounds (VOCs) in the vadose zone beneath the pit. In 1999, an SVE system was constructed to remove the VOCs.

Technical Assistance to Miamisburg Closure Project

SRNL coordinated a national expert assistance panel to provide technical support to Miamisburg Closure Project (MCP), which is developing its final closure strategy for a former landfill and debris disposal area known as Operable Unit 1 (OU-1). The long-term plan for the overall MCP site is a public technological and industrial park called the Mound Advanced Technology Center.

The SRNL-coordinated panel provided technical support to MCP, its regulators and stakeholders in their efforts toward developing a balanced and protective strategy for OU-1. Key findings from the SRNL effort provided bounds on the expected contaminant plume behaviors and initial estimates of natural attenuation rates and processes. The expert panel contributions are documented in a series of publicly-available technical reports.

The various efforts culminated in a public meeting, which provided a forum for feedback and dialog that will be considered and incorporated, as appropriate, into the decisions and plans for OU-1. SRNL provided a briefing on the expert panel results.

Method Development for Determining Particle Size

For each sludge batch that is processed in the Savannah River Site's Defense Waste Processing Facility — which converts high-level radioactive waste into a stable glass form — SRNL performs rheology measurements. (According to chemical engineering professor Faith Morrison, writing in *The Industrial Physicist*, rheology is the study of the flow of materials that behave in an interesting or unusual manner … or the study of gooey, sticky and stretchy substances.)

To help DWPF understand how particle size plays a role in the rheological behavior of slurry, SRNL developed a sieving method for determining particle size and distribution in non-radioactive sludge simulant. The second phase of the project will be implementation of the developed method in the SRNL mock-up and SRNL shielded cells for use with additional simulant slurry and radioactive slurry. The particle size data on radioactive slurries in conjunction with the rheology data will be used to provide guidance for DWPF Simulant Development Program on which sludge preparation procedure should be pursued.

Nonintrusive Level Measurement

SRNL personnel adapted commercially available ultrasonic test equipment and custom components to create a system for nondestructive, nonintrusive level measurement of liquids in a tanker.

The laboratory was asked to support the Savannah River Site's shipment of PUREX to an off-site location. A precise fill level of the tankers was necessary for off-site shipment, and the additional capability to nondestructively detect and measure the amount of any water present would reduce time, effort and expense.

The resulting method is able to obtain measurement of both the amount of PUREX and water in a container holding both. This technique may prove to have a variety of applications in facilities where nondestructive, nonintrusive level measurement is desired.

Measuring liquid levels in PUREX tanker

New Tool Gives Emergency Responders Access to Information

SRNL is participating, along with the University of South Carolina and the Environmental Protection Agency, in a NASA funded project to give hazard response personnel better access to information they need for decision-making. The project is entitled "Development of Remote Sensing-assisted Natural and Technological Hazards Decision Support Systems (DSS)." This DSS will access and process available and relevant information to support decision-making by hazard response personnel. The system will include information on available remote sensing resources that can be used to track and/or predict direction that a hazardous material release will take, and predict the damage, if any, that will occur.

The project is led by Dr. John Jensen of USC and three co-principal investigators from that institution. Dr. John Gladden of the Environmental Sciences and Technology Department leads the SRNL team, while two investigators from the Environmental Protection Agency and one from NASA make up the remainder of the team.

The research will concentrate on four sub-projects that are especially important in the hazard emergency response cycle:

- predictive modeling of human risk and vulnerability to natural hazards in areas surrounding the event using a new and innovative decision support system (DSS),
- natural and technological hazards event planning and disaster response using a new and innovative DSS that identifies all of the remote sensing assets available for analysis,
- demonstration of a near real-time damage assessment for natural hazards and digital image processing of specified imagery, and
- improved management of technological hazards focusing on the development of a new remote sensing-assisted hazardous waste site monitoring DSS.

SRNL's role in the project is focusing on the development of high resolution (e.g. hyperspectral) remote sensing methodologies to detect imminent failure of closure caps, like those used to close and protect areas where hazardous and radioactive waste has been disposed. Tests are being conducted at a set of experimental closure caps constructed near the Savannah River Site Burial Ground Complex.

Various failure modes were induced in the experimental capping systems. SRNL and USC researchers will use a combination of Light Detection and Ranging (LIDAR) techniques to provide fine scale topographic data and hyperspectral data to detect differences in vegetation health, and then will analyze the data to detect and confirm areas where the closure cap has settled or sunk. Detecting these incidents of subsidence, as it is called, is important, because subsidence can be a precursor to the release of contaminants buried beneath the cap. The hypothetical release of contaminants will be analyzed in the remaining hazard analysis tasks.

SRNL Develops New Durability Model for Radioactive Waste Glass

SRNL has developed a new glass durability model that has the potential to allow those facilities that stabilize radioactive waste as a glass form to increase the "waste loading," or the amount of waste that can be incorporated into a quantity of glass. Glass

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durability models predict the durability of the final glass product from the composition of the melter feed.

In 2003, SRNL undertook a research project to develop a new linear and mechanistic high level radioactive glass durability model that would minimize and, if possible, eliminate the need for analyzing every melter feed batch. The resulting model, called the Activated Complex Theory (ACT) model, is based on new theories about the role of activated surface complexes on glass durability. The ACT model is simpler than existing glass durability models and will provide a higher degree of accuracy than the existing models. It is based on simple atomic ratios that express the impacts of glass composition on durability by the conservation of the law of mass action.

Because it is based on elemental ratios of well analyzed sludges and glass formers, process control may be based on the weight ratios of these components, which would eliminate costly and time-consuming analysis of individual melter feed batches. In addition, it provides the technical basis for expanding the process control window, allowing a wider range in such attributes as: waste loading; the alkali content of the glass-formers; and the composition of the radioactive waste sludge. This will allow Purex-type and/or unwashed (high alkali) waste glasses to be processed. Processing of higher alkali (unwashed sludges) and/or the use of more alkali glass formers improves both the melt rate and throughput.

Like the durability model currently implemented in the Savannah River Site's Defense Waste Processing Facility, ACT will provide predictions of any waste glasses radionuclide release. These predictions can be used in the Performance Assessments being developed for the planned federal geological repository. These Performance Assessments assume that all glasses dissolve at an accelerated rate after thousands of years and this limits the compositional range of the waste glasses that must be produced. However, ACT has the ability to predict which glasses will undergo accelerated dissolution and which will not, thus increasing the range of glass compositions that can be processed.

Copper-Catalyzed Peroxide Treatment of Simulated Tank 48H Waste

SRNL conducted scoping experiments to provide information for the team that is evaluating alternatives for the disposition of the high-level waste in the Savannah River Site's Tank 48H. The experiments were designed to determine the effectiveness of copper catalyzed peroxide oxidation, a potential in-tank process for breaking down tetraphenylborate (TPB) in the waste. The TPB in this tank's waste is not compatible with SRS's processes for disposition of radioactive waste.

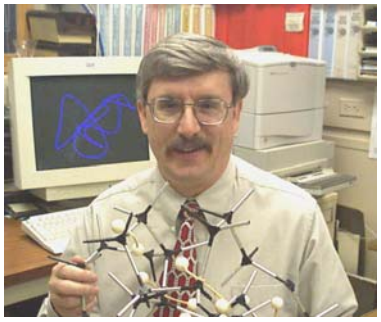
These experiments examined the extent of TPB decomposition at two different pH levels with simulated Tank 48H waste. These experiments measured benzene and oxygen throughout the reactions and determined the decomposition products at the completion of the reaction.

The pH 11 experiment led to complete (greater than 99.8%) and fast TPB decomposition (complete in less than 3 weeks), while providing complete oxidation of TPB decomposition by-products, including benzene. The processing scheme leads to an approximately 83 percent increase in waste volume. The TPB decomposition rate of the scoping pH 11 experiment looks promising for potential application to Tank 48H.

The pH 14 experiment led to a slower TPB decomposition rate and greater increase in waste volume, indicating that this process is not feasible in Tank 48H with the current catalyst system.

PEOPLE NEWS

Wicks Receives Engineering Societies Award


Dr. George Wicks

SRNL's Dr. George Wicks received the prestigious Joan Hodges Queaneau Palladium Medal for 2005 at the 26th Annual Awards Ceremony and Banquet of the American Association of Engineering Societies and National Academy of Engineering May 9. This national award is presented jointly by the American Association of Engineering Societies and the National Audubon Society, and is designed to recognize individuals who encourage cooperation between engineering professionals and environmentalists, to create "innovative solutions to environmental problems." The award was established by the National Audubon Society in 1977 and is only presented in years when the selection committee finds that there is a deserving candidate.

Dr. Wicks is a Consulting Scientist at SRNL, where he has worked for more than 30 years. He is best known for his research and leadership in the field of nuclear waste immobilization and disposal. At the Savannah River Site (SRS), he played a crucial role in the design of the Defense Waste Processing Facility, which is currently in operation converting high-level radioactive waste into a stable glass form suitable for long-term disposition. He has also been instrumental in helping develop waste glass systems and in assessing their long term performance in the environment. He filled a leadership role in national and international efforts to assess and understand the performance of U.S. waste glass products and package components, as well as those from around the world, in four joint field testing programs conducted in Sweden, Belgium, the United Kingdom, and the largest, at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

He also co-developed and patented sol-gel sensors to conduct environmental measurements, teamed with academia to develop a hybrid microwave technology for remediation of various hazardous materials (ex., infectious medical wastes, electronics, etc), and co-developed new a class of composite materials with the ability to store large amounts of hydrogen, effectively, safely and in an environmentally beneficial way.

He has served on many panels for DOE, and advisory groups for the Commissariat `a l'Energie Atomique (CEA) of France and the European Commission, and has also been part of the NATO delegation traveling to the former Soviet Union for nuclear disarmament meetings. He began a new series of international waste management symposia over 20 years ago, which still continues today, in which experts from around the world gather to address important needs in the field. For the first meeting, he received a letter from then-President Ronald Reagan which was read to the participants opening day stating "The issues before you are of the utmost importance to this nation and the entire word."

He is a member and past Chair of the Nuclear & Environmental Technology Division of the American Ceramic Society (ACerS), past President of the National Institute of Ceramic Engineers (NICE), and a member of the Glass & Optical Materials Division in ACerS, as well as being a Fellow in both ACerS and NICE; in 2005, he was elected and inducted into the Board of Directors of the ACerS. He is also a recent recipient of the Arthur L. Frieberg Award, given to individuals who have "made outstanding contributions to the ceramic engineering profession." He has served as adjunct professor to Clemson University and the University of Florida, and currently serves on advisory boards to the University of South Carolina and Virginia Polytechnic Institute & State University.

He has authored or co-authored over 150 publications, 13 patents, four books, served as co-chair of eight international workshops and symposium, and written seven invited chapters in various forums, including text books and two encyclopedias.

Langton Named American Ceramic Society Fellow

Dr. Christine Langton

Dr. Christine Langton of SRNL's Immobilization Technology Section was elevated to status of Fellow of the American Ceramic Society (ACerS) at the society's 107th annual meeting in April.

Dr Langton is a leading expert in concrete, grout construction materials, and low-temperature isotope stabilization. She has authored more than 35 technical publications related to facility closures, waste form development, stabilization of radioactive materials, and materials longevity, and has advanced the fundamental science in the areas of hydrated calcium aluminosilicate cements, magnesium silicate cements, acid-base cement (magnesium phosphate). She has been awarded four patents and one pending in the areas of radioactive and hazardous chemical stabilization, enhancement of the retention of radionuclides, pretreatment processes for wastes, innovative macro-encapsulation of debris and mixed lead metal treatment, and hydrated magnesium silicate cements for geothermal well applications.

Included in her numerous awards for work on radioactive waste treatment and disposal are the E.I. DuPont de Nemours Award of Excellence for the Saltstone Process, the George Westinghouse Corporate Award of Excellence, and four George Westinghouse Signature Awards of Excellence for process development at the Savannah River Site.

Dr. Langton, a member of ACerS since 1981, is a member of the Cements Division (Vice Chair, Secretary, and Program Chair between 1986 and 1992) and Nuclear and Environmental Division (chair 1988/1989). In 1988 and 1989, she was an invited participant in technology exchange delegations to Australia and Scandinavia, respectively. Dr. Langton is also a member of the American Concrete Institute (ACI) and serves on several ACI committees. She is a graduate of the Pennsylvania State University with a Ph.D. in Materials Science and Engineering.

EDUCATION OUTREACH

NASA Award for Proposal with Area Universities

A joint proposal by SRNL, South Carolina State University (SCSU) and the University of South Carolina-Aiken has been selected by NASA for a one-year funding award.

SRNL and the universities developed the proposal for The South Carolina Earth System Science Program in response to NASA's call: Inspiring the Next Generation of Earth Explorers: Integrated Solutions for K-16 and Informal Education. The proposal's objective is to instruct South Carolina K-12 science teachers in meeting South Carolina science standards using NASA information and interactive web-based tools. SRNL will offer teachers a "shadowing" opportunity, so they can see how NASA tools, such as remote sensing, are used to define and solve earth system problems. SCSU is the lead institution on the proposal.

SRNL Supports SRS Tech Days

SRNL employees participated heavily in the annual Savannah River Site Technology Days, a two-day event designed to motivate students to be engineers, physicians and scientists. The event also enables the public to view technologies being developed at SRS and gives site employees the opportunity to display SRS work activities to their families.

This year's event was held at the National Science Center's Fort Discovery in Augusta. The following exhibits spotlighted SRNL activities:

- Nondestructive Examination- Investigating Structural Integrity
- The Power of a Vacuum
- Advancing Hydrogen as a Safe Transportation Fuel
- Light Your Path with Math
- Waste Minimization via Steam Reforming
- The Glass Development Laboratory
- 3D CAD Modeling and Design
- Digital Radiography Applications
- Robotics/Remote Systems Engineering
- Bomb Disposal Vehicles for Use in Iraq

In addition, SRNL employees made presentations or staffed exhibits for other organizations with which the employees are affiliated:

- Central Savannah River Area Robot Warriors (a nonprofit organization that interests young people in engineering by developing a robot for competition on Comedy Central's "Battlebots"): Jabberwock the Battlebot
- American Chemical Society's Colors of Chemistry

Students see a practical application of technology with SRNL's robot for disarming improvised explosive devices in Iraq.

Introduce a Girl to Engineering Day

SRNL personnel participated in the national "Introduce a Girl to Engineering Day" Program, a special event designed to interest girls in careers in engineering. SRNL participants were Monica Hall, Mary Harris, Deb Moore-Shedrow, Cassy Robinson, and Joette Sonnenberg.

During this day-long event, held at the University of South Carolina-Aiken's Ruth Patrick Science Center, approximately 50 girls from 25 middle schools in the Central Savannah River Area interacted with SRNL professionals, along with others from the Savannah River Site. By focusing on middle-school girls, the participants hope to give them a reason to sign up for the math and science courses in high school that will lay the groundwork for studying engineering and related fields in college.

The day included games to help girls discover where their interests lie, as well as interactive, hands-on activities to show them how their natural problem-solving abilities form the basis for many engineering skills.

"Introduce a Girl to Engineering Day" is an offshoot of National Engineers Week. The CSRA Society of Women Engineers helped to sponsor the local event, with support from Westinghouse Savannah River Company (the company that operates SRS, including SRNL, for the U.S. Department of Energy), USC Aiken - Ruth Patrick Science Education Center, Washington Safety Management Solutions and CSRA – American Society for Engineering Management.

DOE Science Bowl

Researchers from SRNL helped spur on the next generation of scientists, engineers and mathematicians by serving as moderators and judges for the 2005 DOE Savannah River Regional Science Bowl. In addition, members of SRNL's Hydrogen Technology Section ran the Fuel Cell Competition, which was included in the Science Bowl events for the first time this year.

Students prepare to race their cars in the Hydrogen Fuel Cell Car Challenge.

Fifteen teams from the Central Savannah River Area of South Carolina and Georgia competed in the regional Science Bowl, which was won by Irmo High School. Students answered questions on the topics of astronomy, biology, chemistry, mathematics, physics, earth, computer and general science. Irmo High School received $750 for their science department and went on to the national competition in Washington, D.C. Lakeside High School placed second and received $500 for their science department, while third place went to Fort Mill High School, who received $250 for their science department. The National Science Bowl is a highly visible educational event and academic competition among teams of high school students who attend science seminars and compete in a verbal forum to solve technical problems and answer questions in all branches of science and math.

Thirteen teams participated in the Hydrogen Fuel Cell Car Challenge, which was added to this year's Science Bowl competition as an enhancement activity. Each team received a hydrogen fuel cell car kit in November. They designed and built their hydrogen vehicles in advance, then brought them to compete in a speed race the day of the competition. First place winner in the Hydrogen Fuel Cell Car Challenge was Dutch Fork High School, followed by second-place Irmo High School and third-place Academy of Richmond County.

University of South Carolina Nuclear Engineering

SRNL's Max Gorensek gave a presentation entitled "Conceptual Design for a Hybrid Sulfur Thermochemical Hydrogen Production Process" to faculty and students from the Nuclear Engineering program at the University of South Carolina.

University of Missouri – Rolla

SRNL's Ralph Nichols gave an invited lecture entitled "Sustainable Environmental Stewardship" to the International Design and Engineering class in the Geological Engineering Department at the University of Missouri – Rolla (UMR). The lecture presented case studies of SRNL's experience with the use of renewable energy in environmental remediation and compared remediation goals to metrics related to sustainability. UMR won the EPA's P3 design competition last year and is submitting another design this year.

Presbyterian College

Steven Serkiz gave an invited seminar to the Chemistry Department at Presbyterian College on "Metal-Doped Carbon Nanomaterials: Production and Applications for Chemical Separations and Hydrogen Storage." Coauthors on the work were Adrian Pishko, Scott McWhorter, and Ragiay Zidan.

Hydrogen Research Project *(Continued from page 1)*

Led by SRNL's Dr. Ragaiy Zidan, Dr. Steven Serkiz and Dr. Scott McWhorter, the project will study the physical and chemical properties of carbon nanotubes, and the mechanisms that these tiny structures use to bond with hydrogen.

Carbon nanotubes are long, thin structures (approximately 1/10,000 the width of a human hair), which can be pictured as a hexagonal lattice of carbon rolled into a cylinder. Recent research has indicated that carbon nanotubes have great potential as a way to store hydrogen in a solid structure because they may be able to bond with large amounts of hydrogen at room temperature.

This project will examine the effect when these structures are doped with a variety of different metals, and will relate physical and chemical properties, such as size, composition and defects, to the nanotubes' ability to bond with and release hydrogen. Researchers will use a combination of laboratory experiments and theoretical modeling to advance their understanding of how metal-doped carbon nanotubes can best be used in hydrogen storage.

SRNL is working with researchers from Virginia Commonwealth University, the Georgia Institute of Technology and Oak Ridge National Laboratory on the project, which is entitled "Elucidation of Hydrogen Interaction Mechanisms with Metal-Doped Carbon Nanostructures."

SRNL is also participating in three other projects, led by Washington University, the Massachusetts Institute of Technology and the University of North Carolina, that were selected as part of the same DOE initiative. Both the Washington University and MIT projects relate to novel materials for hydrogen storage; Dr. Zidan is coordinating SRNL's role in these two. The UNC-led project is one of the Membranes for Separation, Purification, and Ion Transport projects selected by DOE; Dr. Thad Adams is SRNL's lead on this project.

The complete list of projects selected as part of this initiative can be found in the May 25 DOE news release entitled "Department of Energy Announces $64 Million in Hydrogen Research & Development Projects" in the "Press Room" at www.doe.gov.

Plasma Screen Floating Mount *(Continued from page 1)*

Laboratory Consortium for Technology Transfer and the National Association of Seed and Venture Funds, provides an opportunity for investors to gather information on a variety of technologies with global commercialization potential.

Like many SRNL inventions, the Plasma Screen Floating Mount was developed to meet a specific need at the Savannah River Site, but has usefulness far beyond the site's activities.

Manufacturers typically recommend against mounting large plasma screen displays in environments where shock and vibration occur – like in moving vehicles. Researchers at SRNL, however, needed to use a 42-inch plasma display screen in a mobile laboratory that performs environmental monitoring and detection activities while traveling. These activities are often conducted while driving over rough terrain or traveling at highway speeds of 65-70 mph. To solve the problem, Pak and Eakle created a unique mount, which is designed to allow the plasma display to "float" in three dimensions. This floating action eliminates vibration and dampens shock to the display in the event of external impacts such as potholes or rough terrain, and prevents damage to the gas-filled glass platen and other sensitive electronics of the screen.

The working prototype of this patented mount has now been in use in SRNL's mobile laboratory for two years, providing stable, on-the-scene, interference-free video, computer graphics and scientific modeling displays.

With the increasing popularity of flat panel display technology, this new mounting system could have a wide variety of applications, enabling the use of such display screens in mobile medical labs, military vehicles, mobile command centers, environmental laboratories … even recreational vehicles.

Savannah River National Laboratory News is published quarterly by the Savannah River National Laboratory

Dr. G. Todd Wright, Laboratory Director; 725-3994, todd.wright@srnl.doe.gov

Angeline French, SRNL Communications, 725-2854, angeline.french@srnl.doe.gov

Kelly Way, SRNL Employee Communications, 725-3879, kelly.way@srnl.doe.gov

To receive an e-mail reminder when a new issue is available online, send an e-mail to Angeline French at the address above.

Mailing address:

773-A, Savannah River Site, Aiken, SC 29808

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